

COMMENTS BY THE AUTHOR

MOSAIC

and

RELATED DISEASES

OF THE POTATO

of L. zinnii



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MOSAIC AND RELATED DISEASES OF THE POTATO

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This group of diseases has been recognized in the past few years as being the cause for much of the reduction in yield of potatoes. What in the past has been called "running out of potatoes", "degenerate strains", etc. was no doubt due mostly to these diseases.

Mosaic of potatoes is distinguishable only by certain specific symptoms appearing on the leaves. This disease is the most destructive one that attacks potatoes. In this connection it is well to mention that other plants have mosaic diseases that attack them, as for example, corn, squash, raspberries, tomatoes, eggplants, the various legumes, etc.

Symptoms. The disease is characterized by a mottling of the leaves with dark green and light green areas. The light green areas grow more slowly than the dark green areas, thus causing an uneven expansion of the leaf tissue which results in a crinkling of the leaf. In the early stages of the disease the mottling is not well marked but becomes more pronounced in later stages. At first the plants assume natural growth but soon a dwarfing takes place which in time, terminates in typical curly dwarf.

The symptoms are not uniform for all varieties so that one must become familiar with the disease as it appears on different varieties and under different climatic conditions. To illustrate, typical mosaic appears on the Green Mountain variety while usually very little mottling appears on the Netted Gem.

Under Eastern Washington conditions where there is abundant sunshine accompanied by hot, dry weather, a condition known as

"masking of symptoms" occurs. Under these conditions the typical mottling may not appear but if tubers from such mosaic infected plants are planted in the green house or in more humid areas the mottling again appears.

Recently Dr. Quanjer of Holland, after a number of years study, has found several different types of potato mosaic but since they all yield to the same treatment no discussion of them will be made here.

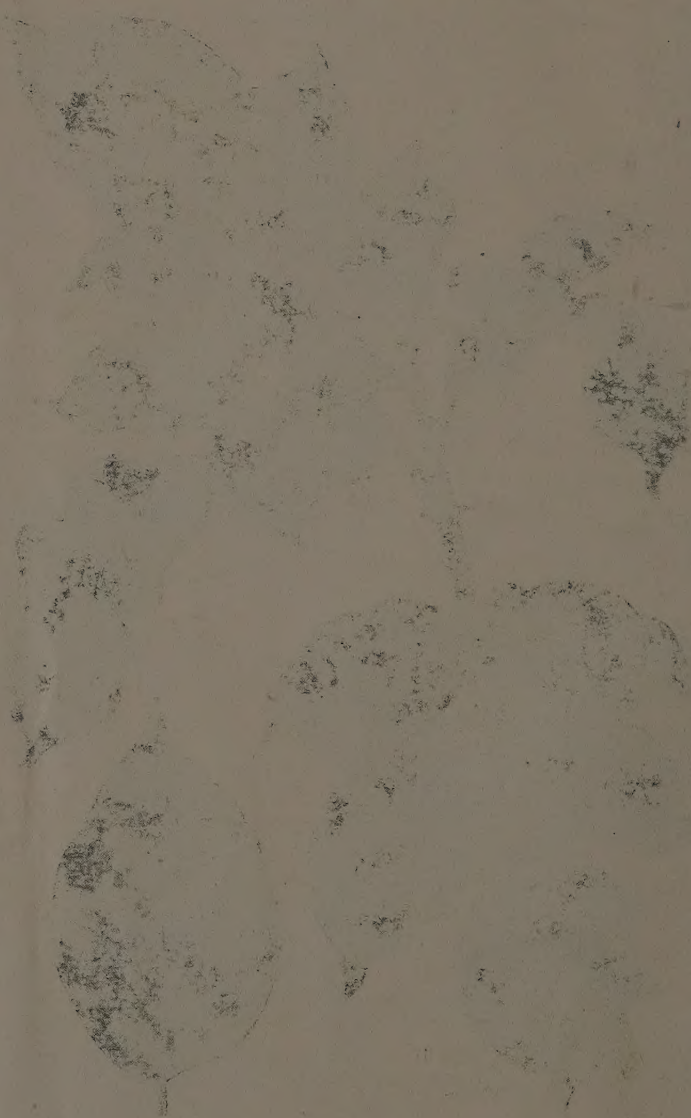
Effects. The effects of this disease vary somewhat under different climatic conditions. Under typical conditions the yield of potatoes is gradually reduced until only one or two tubers are produced in each hill. Certain variations, however, occur as for example, in the northern tier of states, (Wisconsin, Minnesota, etc.) it has been found that even though a patch of potatoes has some mosaic that if seed from such a field is planted under northern conditions no material reduction in yield takes place for a number of years. If, however, this seed is sent to the Southern States it will produce a very poor yield, so that the northern potato seed grower who is producing seed for the warmer areas has a real problem on his hands.

The tubers produced on a mosaic plant are either very poorly shaped or else they are the most perfect tubers in the field and since the disease may be transmitted thru the tubers it makes bin selection of seed a very hazardous proposition.

Transmission of Mosaic. Potato mosaic is transmitted in two ways, 1st, by planting tubers from diseased plants. Second, by means of insects. Experimental work has demonstrated that the virus causing the disease is carried in the sap of the plant. The principle insect carrier is the potato aphid. When an aphid feeds on a mosaic plant and then feeds on a healthy plant the virus is carried with the insect and transmitted to the healthy plant. Furthermore, if an aphid once gets the mosaic virus in its system it can transmit it to its offspring for several generations so that they can infect healthy plants without feeding on mosaic plants themselves. Recent experimental work in Maine has shown that the potato aphid lays its eggs on the rose bush. In the spring the young aphids hatch



Mosaic on the potato vine compared with a normal leaf.



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and soon find a means of going to potato plants if there are any near by. Experiments conducted in Iowa have demonstrated that the mealy bug can also transmit the mosaic virus from diseased to healthy plants. No doubt there are other sucking insects that can also transmit the virus but this remains for future experiments to demonstrate. Recent experiments seem to indicate that mosaic can winter over on certain weeds and act as centers of infection in the spring.

The Nature of the Mosaic Virus has not been understood in the past and even now the knowledge of it is incomplete. The most recent developments seem to indicate that some type of protozoa or amoeba (very low microscopic forms of animal life) are responsible for mosaic. Experimenters in the various states, Hawaii, Java, and elsewhere have located and seen these low forms of animal life in the mosaic diseased areas of various plants. It is very probable then that we are on the verge of a more complete understanding of another type of plant disease hitherto unknown and the scope of plant pathology will be greatly enlarged.

There is a disease of the potato foliage in which deep yellow spots appear which later turn white and finally may disappear. This is "chlorosis" or "calico" and is distinct from mosaic.

Practical Control. No spray or seed treatment has been successful in controlling mosaic except so far as it might control the insects that transmit the disease. We must, therefore, resort to other means of control.

1. Plant only tubers from healthy plants.

2. Use a seed plot that is isolated from any commercial potato fields and every week or ten days vigorously rogue out all mosaic and other objectionable plants. By this means the U. S. Department was able to reduce the amount of mosaic in certain seed stock from 12-15% to less than 1% in one season. The potato growers should realize that mosaic is the worst enemy that has ever confronted the potato growing industry.

Leaf Roll

Leaf roll is a virus disease similar to mosaic causing an upward rolling of the leaves on the midrib, being most pronounced on the lower leaves. Diseased leaves become leathery, somewhat thickened



Typical Leaf Curl

and brittle, while the plants are dwarfed, upright in growth and are rigid with a slightly yellowish color and when shaken emit a sound like the rustling of dry leaves.

Tubers are formed close to the stem and the yield is suddenly reduced. While in mosaic the reduction in yield is gradual and goes down to almost nothing; in leaf roll, however, the reduction in yield is sudden where it usually remains without further decrease.

The disease is infectious and can be transmitted from diseased to healthy plants in the field by aphids; it is also transmitted in the tubers. Frequently a blackening of the vascular ring known as "Phloem necrosis", a type of net necrosis of the tuber, and spindling sprout are associated as symptoms of leaf roll. Recent experiments seem to indicate that this disease is caused by a low form of animal life as in the case of mosaic.

Control: The control measures for this disease are the same as those given for mosaic.

Curly Dwarf

Potato plants affected by curly dwarf have the leaves, petioles and branches much shortened giving the plant a bushy appearance. Usually the leaf tissue is curled or wrinkled upward between the veins and the leaf is thickened. All parts of the plant are usually very brittle and the yield from these plants is very small.

It was once thought that this was a distinct virus disease. It has recently been shown, however, that curly dwarf is in some cases the final stage of mosaic.

Control: See mosaic.

Streak Disease

Streak is a disease that attacks the vines and quickly kills them. It first appears as angular brown spots following the veins in the leaf tissue. Then shortly brown streaks appear longitudinally on the small veins in the leaf which soon collapses and the leaf withers and hangs limp or else the leaf stalks break and hang by a thread, dead and dried.

The mature leaves are the first to be attacked so that there is soon a circle of dead and limp leaves about a third of the way down the vine. This forms a very characteristic symptom. Finally the stem turns brown, the disease progresses downward as long brown streaks and the plant dies.

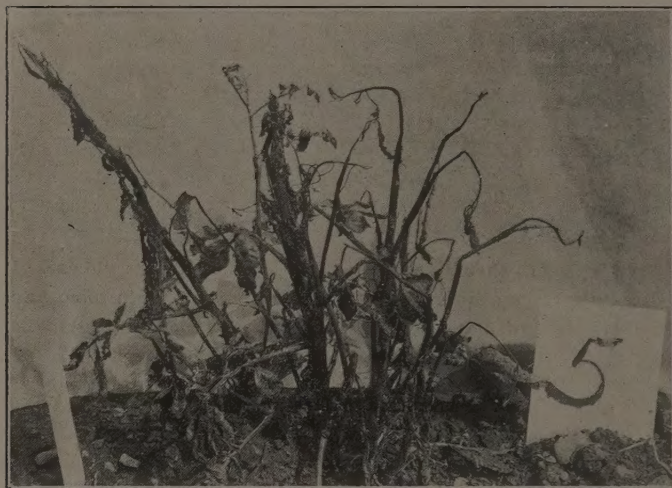
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No symptoms are noted on the tubers. The yield, however, is reduced. Recent experimental work in Eastern Canada has shown that this disease is infectious as is the case with mosaic and leaf roll, and is also transmitted in the tubers.

Control: Rogue out all diseased plants and plant only seed from healthy plants.

Methods of Rogueing and Seed Selection

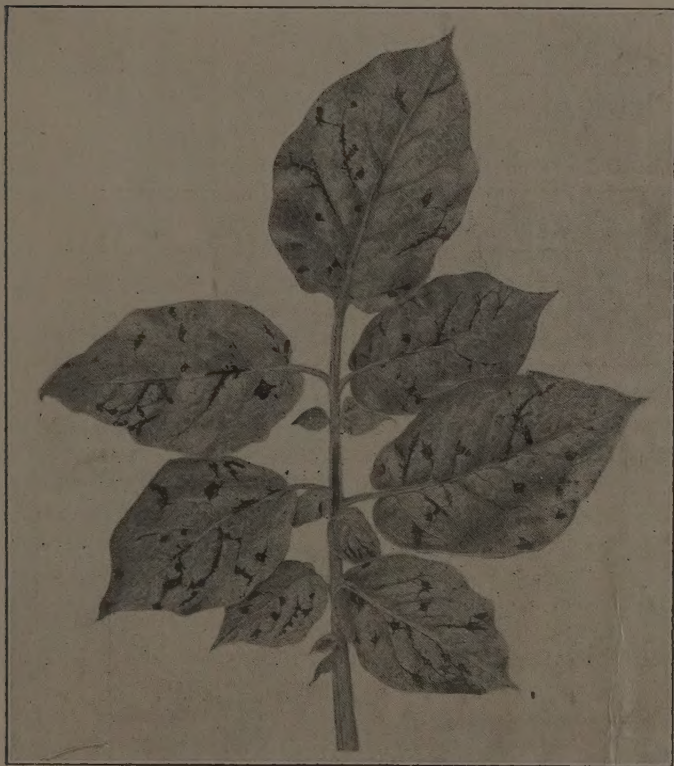
Selection of seed should begin in the growing field. One of the most important operations is the rogueing of fields intended for seed production. When the vines are six to eight inches high



Effect of Streak Disease on Vine

the first rogueing for mosaic plants should be done. The seed grower should be constantly on the look-out during the entire season for mosaic plants and remove and destroy them at once. Later rogueings are necessary to remove plants affected with blackleg, leaf roll, curly dwarf, wilt and other non-desirable plants. In rogueing out diseased plants it is important that the tubers be dug and removed from the field in order to make the control of leaf roll and mosaic effective.

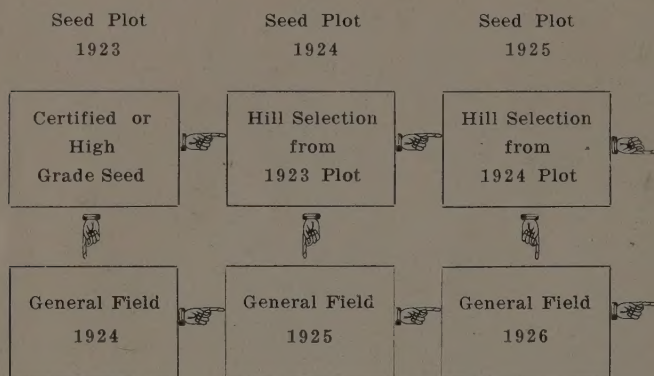
In the production of high grade seed the use of the seed plot is to be recommended which should be handled as follows: The



Detail of Streak Disease

location should be at least a quarter of a mile from the commercial field; the soil should be the most desirable type available and should be plowed deep and well pulverized. It is very essential to thoroughly select and treat the seed stock and plant it sometime in June, and during the growing season the plot should be rigorously rogued at

frequent intervals. Part of the product can be used in the commercial field next season as illustrated in the following chart:



About mid-season the best hills in the field should be selected and staked which at harvest time should be hand dug and if the tuber production is satisfactory they should be used for next year's seed. This method does two things: seed is selected according to vine characters during the growing season and at harvest time according to tuber production. By doing this the results should be (1) less disease (2) higher quality of potatoes and (3) higher yielding strains of potatoes.

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